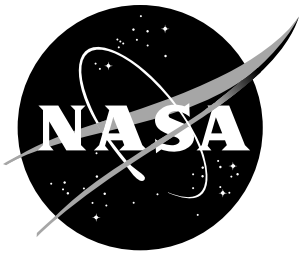

LAPG 1740.2
Effective Date: March 6, 2003
Expiration Date: July 2004

Langley Research Center

FACILITY SAFETY REQUIREMENTS

National Aeronautics and Space Administration

Langley Research Center
DIRECTIVES MANAGEMENT
TRANSMITTAL SHEET

LAPG 1740.2

March 6, 2003

MATERIAL TRANSMITTED

LAPG 1740.2, “Facility Safety Requirements.”

RECISION

LAPG 1740.2, dated July 1999.

SUMMARY

This directive has been revised to update references.

Responsible Office: Office of Safety, Environment and Mission Assurance

PREFACE

This Langley Procedures and Guidelines (LAPG), a part of the Langley Research Center (LaRC) Safety Manual, sets forth LaRC policy, procedures, and criteria for facility safety requirements. These policies are supported by the regulations and standards established by the American National Standards Institute (ANSI), the Occupational Safety and Health Administration (OSHA), and the National Aeronautics and Space Administration (NASA).

LAPG 1740.2, dated July 1999, is rescinded and should be destroyed.

Wallace C. Sawyer
Deputy Director

DISTRIBUTION:
SDL 040, SDL 043, SDL 410, and SDL 412
(LaRC Safety Manual Holders)
429/Office of Safety and Facility Assurance, OSEMA (50 copies)

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Chapter 1

1. INTRODUCTION

1.1 GENERAL

It is LaRC policy to provide a safe and healthful work environment for all employees. To this end, all LaRC employees are charged with the responsibility for ensuring a safe and healthful workplace. Every employee is required to notify line supervision, without fear of disciplinary action or any other form of retaliation, of any hazardous condition where employee injury or equipment damage may result. When notified, a first-line supervisor is responsible for investigating any safety concern raised and for initiating corrective action. Reprisals or disciplinary actions against an employee initiating a safety concern will not be tolerated.

OSEMA is available to assist employees and line management with correcting deficiencies and ensuring that LaRC remains a safe and healthful place to work. OSEMA assistance can be obtained by calling extension 4-SAFE.

1.2 PURPOSE

This LAPG defines minimum safety standards which are required at each facility under LaRC management. These minimum requirements are based on Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI) standards and establish baseline facility safety requirements. They do not replace requirements in existing LaRC directives.

1.3 SCOPE

This LAPG contains the LaRC approach to safe practices and requirements. It identifies potentially dangerous and hazardous situations, and references the proper directive for treatment of such situations.

1.4 CONTRACTOR APPLICATION AND COMPLIANCE

Contractors will apply the minimum safety requirements contained in this LAPG to work done at LaRC. These minimum safety requirements are also specifically defined in SPECSINTACT and are to be included in contract specifications for work to be performed at LaRC.

Contractor personnel must be appropriately trained regarding the safety aspects of work performed throughout LaRC.

Contractors are responsible for supplying special equipment and/or supplies required to safely perform work throughout LaRC.

Chapter 2

2. HAZARD IDENTIFICATION AND MARKINGS

2.1 GENERAL

All Center facilities receive an annual Occupational Safety and Health Audit in order to identify hazards. Audit results are provided to the Facility Safety Head (FSH). If corrective action is required, the FSH must provide closure and post the audit until the discrepancy is closed. If the facility staff cannot correct discrepancies, a LaRC Work Request (Form 69) is used to provide closure. The original Work Request, with the audit response, is forwarded to OSFA for tracking until closure. The scheduled completion of all work requests will be coordinated with the responsible FSH and tracked by the Systems Engineering Competency.

The following personnel are responsible for assuring compliance with the requirements of this section:

- Existing Systems - FSHs and/or Facility Coordinators (FCs).
- New Systems - Design engineers, Technical Project Engineers (TPEs), and/or other personnel directly charged with the acquisition of new hardware.

2.2 UTILITY AND RESEARCH SYSTEMS

Identification of research apparatus, support equipment, and building/facility utilities is mandatory whenever the lines, pipes, components, or vessels are accessible during normal operations or maintenance activities. Identification is accomplished by legends and color coding of the system as described herein. For the purposes of this section, the following systems are excluded from the definitions of utilities:

- Electrical conduit.
- Instrumentation cables.
- Heat/air conditioning ducts.

Utility tunnels are to have markings immediately inside each entrance noting their location.

2.2.1 System Identification

System (function) identification is necessary in order to isolate the system, or a portion of the system, for purposes of operation and maintenance. Schematic layouts, together with condensed operating instructions, will be prepared for each system and/or subsystem. These layouts and operating instructions should be included in relevant Facility documentation.

2.2.2 Hazard Identification

The use of legends and colors has been determined to be the most effective means of alerting personnel to the hazards involved in the operation and maintenance of utility and research systems. Labels and legends are mandatory at LaRC. The use of color codes (in the form of bands) is desirable when and where appropriate, primarily when highly toxic or flammable media are involved. (See Appendix A for legend and color code details; see paragraph 2.4, Physical Hazards, this Chapter, where physical hazards are also involved.)

2.2.3 Legends

Tags, decals, or stencils will be employed to identify pipe or feed line media and direction of flow. Additionally, pressures and temperatures will be identified where appropriate. Specifically, the requirements of this section are supplemented when high pressure systems are involved (see LAPG 1710.40, "Safety Regulations Covering Pressurized Systems"). Banding of pipe markers now in use provides instant 360° location of each decal or legend. Legends should be located approximately every 50-75 feet along continuous lines, on all branches at T joints, wherever lines pass through walls, and so forth. Arrows will indicate direction of flow and point away from the legend. If flow is in both directions, double headed arrows should be used. The legend sizes to be used are illustrated in Figure 2.1. (Figure 2.1, next page, also shows typical arrows and media identification.) Small tags or signs with 1/2 inch lettering may be attached to pipes or vessels under 1/2 inch in size.

All new or replacement legends will be stenciled. If used, color bands should be painted.

2.2.4 Color Coding

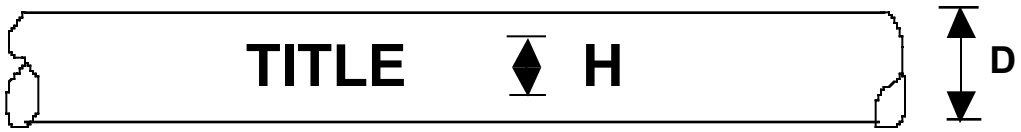
The colors used to signify the various general hazards are based on ANSI 53.1, latest revision. Color bands, spaced at prominent locations along the pipe or device, are considered most appropriate. The general color scheme of the ANSI Code is shown in Figure 2-2 (see Appendix A for specific application to LaRC).

2.2.5 Responsibilities

The following personnel are responsible for assuring compliance with the requirements of this section:

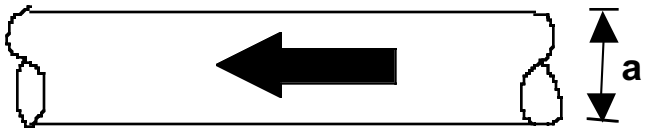
- Existing Systems - Facility Safety Heads (FSHs) and/or Principal Facility Coordinators (FCs).
- New Systems - Design engineers, Technical Project Engineers (TPEs), and/or other personnel directly charged with the acquisition of new hardware.

LEGENDS



D (DIAMETER IN INCHES)		H (HEIGHT IN INCHES)
UNDER	1/2 "	1/2 "
	1/2 " to 3 "	1-1/8 "
	3 " and over	2-1/4 "

ARROWS



ONE DIRECTION

REVERSIBLE

MEDIUM AND STATE

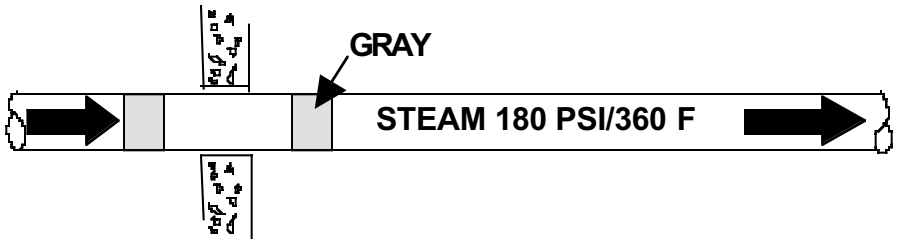


Figure 2.1, Legends

Color Name	Hazard Identification
Yellow	Flammable materials. All materials known ordinarily as flammables or combustibles.
Brown	Toxic and poisonous materials. All materials extremely hazardous to life or health under normal conditions.
Blue	Anesthetics and harmful materials and electrical voltages. All materials productive of anesthetic vapors and all liquid chemicals and compounds hazardous to life and property but normally productive of dangerous quantities of fumes or vapors, and electrical voltage of 600 volts or greater.
Green	Oxidizing materials. All materials which readily furnish oxygen for combustion and fire producers which react explosively, or material which, when in contact with many other materials, can cause spontaneous combustion.
Red	Fire protection materials. All materials provided in piping systems or in compressed gas cylinders exclusively for use in fire protection.
Gray	Physically dangerous materials. All materials not dangerous of themselves but which are asphyxiating in confined spaces, or which are generally handled in a dangerous physical state of pressure or temperature (over 200° F and under 0° F).

Figure 2.2, General Color Scheme of the ANSI Code

2.3 UNDERGROUND UTILITIES

Mylar detectable tape or its equivalent will be used in all installations and maintenance tasks for buried underground facilities at LaRC, to include laying detectable tape approximately 6 inches below the surface of the ground directly above buried utility lines. This policy is consistent with OSHA regulations which stipulate that personnel will be protected from hazards created by excavating or trenching in the vicinity of dangerous underground facilities.

Excavation or other surface penetration activity (including landscaping) performed on LaRC premises either by in-house or contractor personnel presents a potential safety hazard. Accordingly, a "Digging Permit" system has been developed to control actual or potential disturbance of existing surfaces to a depth in excess of 6 inches. The Underground Utilities Coordinator, Systems Engineering Competency, has been designated as the focal point for control of the buried/underground utility systems at this Center. Digging permits (Figure 2.2,) will be issued by the Underground Utilities

- NASA-LaRC -

D I G G I N G P E R M I T

THE ISSUANCE OF THIS PERMIT DOES NOT REDUCE THE CONTRACTOR'S LIABILITY FOR DAMAGE DONE TO DRAWING-IDENTIFIED GOVERNMENT PROPERTY WHICH MAY OCCUR DURING EXCAVATION.

COMPANY _____

LOCATION _____ **SAMPLE** _____

_____ _____

ESTIMATED PERIOD - START_____STOP_____

UTILITIES DWGS. ISSUED TO _____DATE_____

DESIGNATED CONTRACTING OFFICER'S REPRESENTATIVE OR INSPECTOR

NAME_____DEPT._____PHONE _____

UNDERGROUND UTILITIES COORDINATOR APPROVAL

_____ _____

DATE

Figure 2.3, NASA LaRC Digging Permit

Coordinator upon request. Early identification of excavation/penetration requirements will assist the Underground Utilities Coordinator in planning drawings and survey support efforts.

It is the responsibility of the designated Contracting Officer's representative or inspector to assure the following steps are performed in connection with actual "digging" operations of contractors at LaRC:

- Notify the Underground Utilities Coordinator at least 24 hours in advance with the specific details.
- Coordinate a specific time prior to the start of excavation operations to meet with the contractor and LaRC survey personnel at the work site. Survey personnel will mark all existing utilities, provide the contractor with current work site utility drawings, and issue the Digging Permit.

- Verify that the contractor conforms to all published requirements during the excavation/penetration process (including appropriate barricades and warnings) and prominently displays this authorization.
- Notify the Underground Utilities Coordinator (or agents) prior to back fill so that affected documents can be verified and/or red lined.
- Remove and return the sign and permit to the Systems Engineering Competency, at the completion of the operation if the Underground Utilities Coordinator (or agents) have not already done so.

2.4 PHYSICAL HAZARDS

This section recognizes the dangers resulting from people being too close to physical hazards, and provides a LaRC system of marking and color coding.

2.4.1 Color Coding

For each type of hazard identified, a specific color is required as specified:

Color	Hazard Identification
Red	Fire protection equipment and apparatus. Containers for flammable liquids having a flashpoint below 100° F. Emergency stop bars or buttons on hazardous machines.
Orange	Dangerous parts of machinery or energized equipment which may cut, crush, shock, or otherwise injure. Enclosure doors are open or when gear belts or other guards around the moving equipment are open or removed, exposing unguarded hazards.
Yellow	Caution and for marking physical hazards such as falling, stumbling, striking against, tripping, or getting caught in between objects. Solid yellow, yellow and black stripes, yellow and black checkers (or yellow with suitable contrasting background) should be used interchangeably, and using a combination which will attract the most attention in the particular environment.
Green	"Safety" and the location of First Aid equipment (except fire fighting equipment).
Blue	Warning against the starting, the use of, or the movement of equipment under repair or being worked on.
Magenta (Purple and Yellow)	Radiation hazards.
Black, White, or a Combination	Traffic and household markings. Solid black, solid white, single color striping, stripes of black and white, or black and white checkers should be used in accordance with local conditions.

2.4.2 Identification Clarification

In general, the use of color coding is intended to identify the immediate area where the physical hazard exists. Consequently, excessive use of warning color (overpaint) defeats the identification of the specific hazard and tends to make the program ineffective. Further, multiple hazard identification requirements must have a criteria for determining precedents. The LaRC standard is that the most serious hazard determines the appropriate color coding, as shown by the following examples:

- Where no physical hazard exists, black and white are used for housekeeping walkways and work areas. However, when physical hazards intrude into these spaces, yellow or combination yellow and black is to be used for marking.
- When a utility or research system also represents a physical hazard, the physical hazard color coding represents the overriding requirement. The piping or device is to have a legend and be painted yellow or yellow and black. Also, utility color bands at appropriate intervals may be added to the basic physical hazard color where appropriate.

2.5 POTENTIALLY HAZARDOUS MATERIALS

Communications concerning hazardous chemicals and their safe use are extremely important. Hazard awareness is increased through the use of warning labels. The use of color codes reduces the danger to the individual by enabling the person to immediately identify and evaluate the hazard/risk posed by the various materials stored or being used. Therefore, personnel engaged in tasks requiring the use of potentially hazardous materials must have a good working knowledge and understanding of the criteria and requirements outlined in LAPG 1710.12, "Potentially Hazardous Materials." OSHA mandated Hazard Communication and Chemical Laboratory Safety Standards are also outlined in LAPG 1710.12 as well as requirements for permits for use of hazardous materials.

The type of risk is identified by color (blue--health; red--flammability; yellow--reactivity; and white--other hazards). The degree of danger is determined on a scale of 0 to 4; with 0 representing minimal danger and 4 indicating extreme danger, possibly death. This identification system is further described in LAPG 1710.12 and in National Fire Protection Association (NFPA) 704, "Standard System for the Identification of the Hazards of Materials for Emergency Response." Additional information and assistance is available from the Office of Safety and Facility Assurance (OSFA), Office of Safety, Environment and Mission Assurance (OSEMA), particularly for instances involving contractor activities.

2.6 ALLOWABLE FLOOR LOADS

The Center's annual OSHA inspection will determine the initial need for allowable floor load identification. Thereafter, each FSH and/or the FC is responsible for assuring that appropriate floor loading signs are displayed and the design loading is not exceeded.

The use and marking of these signs will be in accordance with the following criteria.

- Markings are not required on concrete slab constructed directly on earth/fill.
- All floor areas will be marked in accordance with engineering design criteria as to the loads approved for the area by the Systems Engineering Competency.
- OSFA, OSEMA, will furnish the signs upon request or as a part of facilities safety and health audit.
- Areas with an allowable load of 300 psf and above will be marked with notice signs; below 300 psf will be marked with caution signs. In both cases, the signs will display the actual approved load in pounds per square foot.
- Sufficient signs will be placed in the space to which they relate so that building occupants will be aware of the loading limitations.
- All drawings and specifications involving new construction must indicate allowable floor loadings and provide for the appropriate signs.

2.7 SIGNS--INDUSTRIAL, TRAFFIC SAFETY, AND INFORMATION

The following procedures are to be used to ensure compliance with LAPD 1500.5, "Signs and Directory Boards," appropriate codes and standards, and to control location and type of signs:

- Obtain Office of Security and Public Safety (OSPS) approval for all short/urgent Work Orders and/or NASA Langley Form 69s ("LaRC Work Request") requesting traffic and/or parking lot changes. **NOTE:** Industrial and traffic safety signs are available from OSPS and OSFA, OSEMA, respectively.
- Obtain approval of the Office of Logistics Management (OLM) for all other types of signs such as facility names and reserved parking designations. **NOTE:** Signs will not be fabricated or installed without appropriate authorization by either OSEMA or OLM.

Chapter 3

3. SPECIAL SYSTEMS REQUIREMENTS

3.1 PRESSURE SYSTEMS

NASA policy applicable to these systems is set forth in NPD 8710.5, "NASA Safety Policy for Pressure Vessels and Pressurized Systems." Guidelines for the application of this policy to ground based systems are contained in NPG 1700.6A, "Guide for Inservice Inspection of Ground-Based Pressure Vessels and Systems," which has been accepted by the Department of Labor as "equal to or better" than OSHA standards.

3.1.1 Systems Requirements

LaRC implementation of the Agency requirements is contained in LAPG 1710.40, "Safety Regulations Covering Pressurized Systems."

3.1.2 "Witnessing" Policy

Hydrostatic or pneumatic testing of pressure systems is a basic requirement of LAPG 1710.40. It is required that the acceptance testing of pressure systems used on LaRC experimental equipment, or being procured for use at LaRC, be witnessed as follows:

- Pressure tests conducted elsewhere for systems to be used at LaRC are to be witnessed by a representative such as the LaRC Resident Engineer, or other selected NASA personnel.
- Testing of pressure systems (at or away from LaRC) which are not destined to become a part of an LaRC facility system should be witnessed as determined by the responsible LaRC Project Manager.

3.2 MECHANICAL SYSTEMS

LaRC Machinery Safety Policy requires, as a minimum, that new and existing machinery will be in accordance with the latest OSHA, Part 29 CFR 1910 requirements. LaRC mechanical requirements applicable to machinery are:

- Machines (manual or powered) must be properly anchored to prevent walking or moving. Specifically, any machine must be anchored that might move or walk because of unbalanced operation (tipping) or because it is located so that passing heavy equipment could impact or upset the machine. Excluded from this requirement are tools and machines explicitly designed for portable use.
- Existing machinery will be brought into compliance with OSHA standards which require the machine operator and other employees to be protected from rotating and moving parts. The LaRC annual safety and health inspection will identify those machines requiring corrective action.

- All purchase requests and contractual commitments which include machinery must contain in the specifications a requirement that guarding is in compliance with OSHA, Part 1910, Subpart "O." All such specifications will be reviewed and approved by the Safety Manager.

3.3 ELECTRICAL SYSTEMS

The basic LaRC standard for these systems is the OSHA recognized National Electric Code (NEC). Specific LaRC policy and interpretations of the NEC are contained in LAPG 1710.6, "Electrical Safety."

3.3.1 Working Clearances

LaRC has adopted the working clearances specified by the NEC, Section 110-16, entitled "Working Space About Electrical Equipment (600 Volts or Less)."

3.3.2 "Hot Stick" Safety Procedures

Due to the extremely hazardous potential of discharging high electrical storage, special requirements are specified. LaRC "Hot Stick" safety procedures for each High Voltage Test Facility are required to be written as a detailed step by step outline of how to safely deenergize capacitor banks prior to making changes or adjustments. Each facility "Hot Stick" procedure will conform to the requirements of LAPG 1710.6.

3.4 WATER CONNECTIONS

Contamination of the potable water supply is prohibited. LaRC policy has established safeguards against possible contamination of the fresh water supply caused by backflow or back siphonage. These safeguards are:

- Where the possibility of a cross connection may exist, backflow prevention devices, or the equivalent, will be installed and tested periodically.
- Any suspect cross connection or suspect contamination of fresh water will immediately be reported to the FSH.

Chapter 4

4. FACILITIES AND STRUCTURES SAFETY

4.1 SCAFFOLDING

It is LaRC policy to assure compliance with minimum safety requirements in the design, construction, erection, and use of scaffolding platforms, metal and wood; and including all varieties of fixed and mobile self-supporting, suspension, and special types of scaffolding. The basic standard applicable to these devices, when utilized by Center employees or support service contractors, is OSHA, Part 1910.28. (See OSHA, Part 1926.451 for construction industry standards.)

4.1.1 Responsibilities

It is the responsibility of OSFA to ensure that purchased, fabricated (temporary), or issuance of existing scaffolding, to be used by either LaRC or its construction contractor personnel, conform to the OSHA requirements. Additionally, OSFA will certify all newly erected staging (prefab-type scaffolding), including the type of platform to be used, as safe prior to its use.

4.1.2 Line Management

Facility Coordinators, Construction Inspectors, or designated Contracting Officer's Technical Representatives (COTR)/Contract Monitors will ensure that:

- When working from suspension-type scaffolding, each worker is protected by an approved safety harness attached to a lifeline. The lifeline must be securely attached to substantial members of the structure (not the scaffolding), or to securely rigged lines which will safely suspend the worker in case of a fall.
- Any scaffold, including accessories such as braces, trusses, screw legs, ladders, and so forth, damaged or weakened from any cause, will immediately be repaired or replaced.

These personnel are also responsible for ensuring the prompt and safe dismantling of scaffolding and staging when no longer required.

4.1.3 General Requirements

Personnel using scaffolding at LaRC must observe the following requirements:

- Scaffolds will not be erected, moved, dismantled or altered except under the supervision of authorized competent persons (OSFA, extension 47233). Furthermore, scaffolds will not be altered or moved horizontally while they are in use or occupied.
- The footing or anchorage for scaffolds will be sound, rigid, and capable of carrying the maximum intended load without settling or displacement.

Unstable objects such as barrels, boxes, loose brick, or concrete blocks must not be used to support scaffolds or planks.

- Guardrails and toeboards (minimum height of four inches) will be installed on all open sides and ends of platforms more than 10 feet above the ground. Hand rails, 2 inches by 4 inches or the equivalent, will be installed no less than 36 inches or not more than 42 inches high, with a midrail, when required, of 1 inch by 4 inch lumber or equivalent.
- Supports for guardrails and toeboards will be at intervals not to exceed eight feet.
- Scaffolds and their components will be capable of supporting, without failure, at least four times the maximum intended load. To assure that the working load is not exceeded, the maximum capacity must be displayed on a tag or plate firmly affixed to the scaffolding or staging.
- An access ladder or equivalent will be provided.
- Scaffolds must be secured to permanent structures through the use of anchor bolts or other equivalent means. Window cleaner anchor bolts will not be used.
- The use of shore scaffolds or lean-to scaffolds will be prohibited.
- Wooden scaffolding requirements also specify that:
  - Planking lumber grade, maximum permissible span, and nail or bolt requirements shall be as specified in the appropriate sections of OSHA, Parts 1910.28 and 1926.451.
  - Plankings or platforms shall be overlapped a minimum of 12 inches, secured from movement, and extended over their supports not less than six inches or more than 12 inches.
  - Poles, legs, and uprights of scaffolds shall be plumb and securely and rigidly braced to prevent swaying and displacement.
- Special considerations which must be tailored to the individual application are specified in detail in the two OSHA standards, and include:
  - Tag lines and tie-offs.
  - Overhead protection.
  - Underneath protection.
  - No work conditions.
  - Rope protection.
  - Fire prevention.
  - Uplift locks.
  - Maximum occupancy.
  - Adjacent heat sources.

4.2 HIGH WORK

LaRC policy prescribes safety requirements and procedures for assigning employees tasks that involve working at elevated levels, commonly referred to as "high work."

4.2.1 Elevated Levels

Working spaces 25 feet or more above ground level which are not enclosed by normal structural walls and ceilings are considered elevated. This definition is consistent with ANSI and OSHA, Part 1926 standards and includes substations, gantries, and certain hazardous roofs. Not included are internal balconies and flat roofs having appropriate floor loading capacity and OSHA compatible rails, guards, parapets, and so forth. Levels less than 25 feet may be categorized as elevated if supervision determines that unusual exposure conditions so warrant.

4.2.2 Elevated Level Worker

A worker performing high work, i.e., normal or periodic duties or assignments which require that the worker function at elevated levels, is an elevated level worker.

4.2.3 Safety Requirements

Before assigning employees to work at elevated levels, supervisors will ensure that the following safety requirements and precautions are observed:

- Provide adequate safety measures, equipment and/or devices to minimize any potential hazard that could be encountered while working at the elevated levels. These devices include, but are not limited to, safety harnesses, guardrails, lifelines, and/or scaffolds.
- Instruct employees regarding working at elevated levels specific to the tasks that are to be performed. Paramount to such instruction will be the daily inspection of all safety equipment to be used. In inclement weather, only emergency operations will be permitted.
- Employees are to obtain medical examinations to ensure that they are physically qualified to perform assigned tasks at elevated levels.
- Make certain that the employee is physically capable of performing work at elevated levels each day the employee is assigned this type of task. If there is any doubt or reservation as to the employee's physical capabilities (even though the employee may have previously been medically certified to perform at elevated levels), the assignment should be deferred. Be alert to any indications of the effects of alcohol, drug consumption, or mental stress.

4.2.4 Responsibilities

Supervisors are responsible for complying with the requirements of this section. Supervisors should refer all questions relative to working at elevated levels to the Safety Manager, or the Occupational Health Officer, Office of Human Resources, for advice and guidance.

Upon receipt of a completed NASA Langley Form 66, "Worker Appointment and Certification Form," the Occupational Health Services Office (OHSO) will arrange for physical examinations of employees subject to working at elevated levels. Examinations will specifically include consideration of physical defects or conditions

that could create a potential hazard while working at elevated levels (for example, vertigo, epilepsy, fainting spells, and so forth).

The OHSO is responsible for certifying, on NASA Langley Form 66, that employees examined have been found medically qualified to perform work at elevated levels. This certification will be made prior to initiation of work and/or whenever deemed necessary.

The certifying official will be the Safety Manager, who will verify the proper completion of NASA Langley Form 66, maintain certification records, and provide authorizing documentation.

OSFA, OSEMA, will counsel supervisors regarding appropriate safety precautions and approved safety devices to be used when working at elevated levels.

4.3 ROOF WORK

LaRC roof areas are not generally designated as work areas. However, tasks such as equipment maintenance, roof repair, and various types of construction projects are occasionally performed on these surfaces. The following chapters establish the minimum safety requirements for these activities.

4.3.1 Access Control

It is the responsibility of the FC to control access to these potentially hazardous roof areas. To support the FC in this function, the following requirements are established:

- All accesses to hazardous roof areas will be identified by appropriate warning signs.
- All personnel requiring access to roof areas will notify the FC and obtain approval prior to performing any roof activity.
- Where structural integrity or permanent safety devices do not provide sufficient protection to confine the risk to the simple "high work" category (see High Work, paragraph 4.2), special security, safety equipment and/or procedures, and temporary structural requirements will be specified and conspicuously documented by the facility. The Systems Engineering Competency, in conjunction with the Safety Manager, will assist the FC in developing these specifications.
- All Center personnel will assist the FC in identifying unauthorized building interior and exterior access to roof spaces.

4.3.2 Equipment Access

Where access to roof-located equipment (for example, heating, ventilation, and air-conditioning, aircraft warning lights, pressure systems, instrumentation stations, and so forth) is required, the following apply:

- Permanent working platforms, associated walkways or ladders, and appropriate rails and guards must be provided in accordance with OSHA, Part 1910 standards.
- Those workers requiring access will be identified and certified as "high workers."
- Approved safety equipment and procedures will be used for these operations.

For buildings with adequate structural integrity, the same requirements described in paragraph 4.3.1 of this chapter apply to roof repair or modification. Roof activities on surfaces that are structurally inadequate, or which are not permanently configured for such work, have the following additional requirements (all cement-asbestos paneled roofs are automatically in this category):

- Internal building access to these roofs must be secured by locks and the keys maintained by the FC or alternate.
- Roof prime load-carrying members (or alternatively the minimum spans that guarantee load support), including allowable loads, will be identified and documented in the Facility files.
- Prior to initiation of roof repair or modification, the affected parties (NASA, contractor or subcontractor) will be briefed on both the potential hazards and recommended minimum safety considerations associated with the performance of the specific roof task. The responsibility for this coordination depends upon the personnel performing the task:

Worker	**Responsibility**
NASA/LaRC	Facility Safety Head/FC
Support Service Contractor	COTR and/or Technical Monitor
Construction	Assigned Inspector Contractor

4.4 CONFINED SPACES

Any space not intended for continuous employee occupancy, having a limited means of egress, and which is also subject to either the accumulation of an actual or potentially hazardous atmosphere or a potential for engulfment is considered to be a confined space. Confined spaces generally include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, manholes, underground utility vaults, acid tanks, digesters, ovens, kiers, pulpers, tunnels, furnaces, degreasers, test chambers, compartments, vats, certain locations within aircraft and spacecraft when not in flight, and pipelines. Open top spaces more than four feet in depth, such as pits, tubs, vaults, and vessels, may also be confined spaces.

It is LaRC policy, applicable to all personnel, contractors, and operations at NASA, to prevent exposure to dangerous air contamination when entering into and working within confined spaces. Dangerous air contamination is any atmosphere presenting increased risk of health impairment, injury, disablement, or death, such as:

- Combustible or flammable gases and vapors at concentrations in excess of 10 percent of their lower explosive limit.
- An oxygen concentration less than 19.5 percent or greater than 23.5 percent by volume.
- Toxic substances present at concentrations in excess of their permissible exposure limits or threshold limit values (TLVs).

NOTE: OSHA exposure standards (29 Code of Federal Regulations (CFR) 1910) will be used unless the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs are more restrictive, in which case ACGIH guides will be used.

4.4.1 Responsibilities

Supervisors will have overall responsibility for entry and work in confined spaces and for ensuring that the requirements of this standard are implemented. Since the LaRC fire department is trained and equipped to conduct confined space rescue, the fire department (extension 45600) shall receive prior notification that there will be a confined space entry. Supervisors will request assistance from the LaRC Industrial Hygiene function, OSFA, OSEMA, if there is any doubt about whether a location meets the criteria of a confined space. The LaRC Industrial Hygienist (for Civil Servants) and the contractor Safety function (for contractor personnel) will:

- Evaluate and approve entry by permit and/or operating procedures.
- Review equipment to be used.
- Ensure that atmospheric measuring equipment is installed, maintained, calibrated, and used properly.
- Assist supervisors in identifying and posting areas to be considered confined spaces and in training or approving training programs for personnel entering confined spaces.
- Test the atmosphere, or as deemed appropriate, certify other personnel to perform this task.

4.4.2 Permit/Procedure System

An OSEMA Organizational Form N-1222, "Confined Space Entry Permit," or approved procedure where entry is on a routine basis and hazards are well known, will be required (see Figure 4.1, next page). Attention to detail similar to that of the Entry Permit will be required for an approved procedure. An approved procedure must be updated and reviewed at least annually.

4.4.3 Posting

Confined spaces will be posted at all times with the sign shown in Figure 4.2. During periods when work is scheduled within the confined space, a copy of the permit or procedure will also be posted.

CONFINED SPACE ENTRY PERMIT

SECTION I - TO BE COMPLETED BY SUPERVISOR

Permit Valid From Date _____ Time _____ to Date _____Time _____	Location and Description of Work
Chemicals to Be Used (describe fully)	
Previous Contents	Entry and Stand-by Personnel (Names)

Expected Entry Date	Expected Entry Time	Outside Contractors (Name)

Hazards Expected:(Describe)

☐ Corrosive Materials	_____	☐ Cleaning (Ex. Chemical or Water Lance)	_____
☐ Hot Equipment	_____	☐ Spark-Producing Operations	_____
☐ Flammable Materials	_____	☐ Spilled Liquids	_____
☐ Toxic Materials	_____	☐ Other	_____
☐ Inert Gases	_____		

Completed by (Name)	Telephone Number

SECTION II - TO BE COMPLETED BY CONFINED SPACE MONITOR

Hazards & Other Factors To Be Evaluated (From Section I)

SECTION III - TO BE COMPLETED BY CONFINED SPACE MONITOR OR DESIGNEE

Initial Atmos. Tests Perf'd.	Location	Concentration	Remarks
Explosibility (LEL)			
Oxygen			Initial Tests Performed By
Toxic Contaminant			
Dusts			Time / Date
Other			

Atmos. Tests (Follow-Up)	Location	Concentration	Time	Remarks
Explosibility (LEL)				
Oxygen				Periodic Tests Performed By
Toxic Contaminant				
Dusts				Date
Other				

SECTION IV - TO BE COMPLETED BY SUPERVISOR AND CONFINED SPACE MONITOR

Protection Gear	Yes	No	Type/Comment
Respirators			
Protective Clothing			
Protective Helmets			
Eye Protection			
Foot Protection			
Life Lines & Harness			
Lighting			
Communications Equip.			
Ventilation			
Monitoring Equip.			

Remarks	Isolation Checklist
Training Have entry and stand-by employees received proper training? ☐ Yes ☐ No	☐ Blanking and/or disconnection ☐ Other: ☐ Electrical _____ ☐ Mechanical _____ ☐ Tagging and Lockout _____

Special Entry and/or Work Procedures

CERTIFICATION

I certify that all requirements of this Confined Space Entry Permit have been met.

Signature of Supervisor	Time	Date	Actual Time of Entry

NASA Langley (Rev. September 1997) N – 1222

Figure 4.1, Confined Space Entry Permit

Figure 4.2, Confined Space Warning

4.4.4 Training

All employees required to enter confined spaces (including standby employees) will be trained regarding the nature of the hazards involved and trained in operating and rescue procedures, including the necessary precautions to be taken and the proper use of required personal protective and emergency equipment. Procedures must be thoroughly explained so that each person is aware of the proper action to take under varying circumstances. All persons must be totally familiar with the system of communication used during confined space work.

4.4.5 Atmospheric Testing

Prior to entry into a confined space, atmospheric tests will be conducted to determine the presence of dangerous air contamination. Subsequent atmospheric testing with hourly recording is required.

4.4.6 Ventilation

In all cases of dangerous air contamination, ventilation will be recommended as the primary means of control. Continuous general dilution or local exhaust ventilation will be maintained where dangerous air contamination is produced as part of a work procedure (for example, cleaning with solvents, welding, or painting), or where dangerous air contamination may develop due to the nature of the confined space (for example, desorption from walls or evaporation of residual chemicals). Ventilating a confined space does not eliminate the need for atmospheric testing.

Ventilation equipment used to prevent situations that are immediately dangerous to life and health will have an audible warning device to signal ventilation system failure.

It is good practice to ventilate all confined spaces before entry and during occupancy even though no dangerous air contamination is present.

4.4.7 Prevention of Dangerous Air Contamination

Accidental introduction of dangerous air contamination into the confined space through interconnecting equipment such as piping, ducts, vents, drains, and so forth, will be prevented by positive means such as lock-out and tagging, disconnection of pipes, blind flanges, two block valves with an open vent between them, or other procedures.

4.4.8 Electrical Equipment

Since tanks, damp manholes, and so forth, often constitute "massive electrical grounds," electrical circuits in confined spaces will be deenergized and locked out as warranted due to the potential for electrical shock. Any electrical equipment used inside confined spaces should be properly insulated and grounded. Only explosive-proof electrical equipment, in accordance with Article 500 of the NEC, and nonsparking hand tools will be used in confined spaces subject to contamination by combustible/flammable vapors, gases, or particulates. Where possible, it is desirable to use pneumatically driven power tools equipped with conductive air supply hoses. Nitrogen or other inert gas pressure will not be used as a substitute for air pressure unless specifically approved by the confined space monitor. All hand-held electrical equipment must have a ground fault interrupter circuit breaker (4 to 6 mA where possible) at the power source unless the power source is an ungrounded portable generator, an ungrounded battery source less than 28 volts, or an ungrounded isolation transformer of less than 28 volts.

4.4.9 Personal Protective Equipment for Civil Servants

Protective equipment will be used as follows:

- Suitable goggles or full-coverage face shields with goggles, impervious outer clothing, gloves, hood, and boots must be worn, as necessary, to protect against irritating, corrosive, or toxic contaminants.
- Hard hats must be worn in confined spaces when circumstances so warrant. Hard hats must meet the requirements specified in 29 CFR 1910.135.
- Depending on the extent of the hazard, lifelines and safety harnesses may also be required. Safety harnesses will be certified according to Section 4 of ANSI A10.14-1975. Lifelines may not be less than 1/2-inch nylon (5/8-inch preferred) or 3/4-inch manila rope of good quality without splices. Lines must be inspected periodically to ensure that they are free from defects. A line will be securely attached to the harness, and the free end of the line should be secured outside the entry opening, checked prior to entry, and not be removed while inside the confined space. The safety harness will be of the type that

permits easy rescue of persons from the confined space during emergency conditions. In cases where the size of the entry/exit opening is less than 19 inches, a wrist-type harness will be used. Where possible, a hoisting device or other effective means can be provided for lifting personnel out of the confined space.

- Respiratory protection needs for civil servants will be determined by LaRC Industrial Hygiene personnel (OSFA, OSEMA), based upon conditions and test results of the confined space and the work activity to be performed. Respirators will be NASA/National Institute of Safety and Health (NIOSH)-approved devices and will be fitted, used, and maintained in accordance with OSHA respiratory protection, air contaminant, and other applicable standards. The quality of air used in supplied-air respirators will meet OSHA requirements (Compressed Gas Association Grade D). Annual physical examinations to determine ability to use respiratory protective devices and perform the work that may be required shall be administered to all personnel who work in confined spaces, including standby personnel. Only when ventilation has been found to be impractical or ineffective will personal respiratory protective equipment be required as a primary means of control.

4.4.10 Standby Personnel

Standby personnel will be positioned outside confined spaces to give assistance in cases of emergency. Standby personnel will have no assigned duties to perform other than to observe and communicate with persons inside the confined space. Audible voice, radio/telephone, constant visual, or other suitable forms of communication between the persons in confined spaces and standby personnel will be continuously maintained. The system will be tested immediately upon entry to confirm its effectiveness. Also, standby personnel will have a communication link with additional persons who can render help in emergencies. The LaRC fire department is trained and equipped for confined space rescue and, should rescue become necessary, they shall be called on extension 911.

4.5 ASBESTOS

Asbestos is a generic term for a number of naturally occurring, hydrated mineral silicates, incombustible in air and separable into filaments, such as chrysotile, amosite, crocidolite, and other forms as described by OSHA.

It is LaRC policy to prevent exposing personnel or the environment to friable asbestos in accordance with Federal, State, and local regulations applicable to asbestos. This applies to all personnel and operations at LaRC, including contractors. Present Commonwealth of Virginia regulations exempt Federal facilities from having a Project Monitor on site for asbestos abatement projects unless the abatement is greater than or equal to 1600 square feet or 2500 linear feet. According to 40 CFR 763, Subpart E, Appendix C6, Project Monitors observe abatement activities performed by contractors and generally serve as a building owner's representative to ensure that abatement work is completed according to specifications and in compliance with all relevant statutes and regulations. It is a conflict of interest under present Commonwealth of

Virginia regulations for a contractor to have an employee/employer relationship with or a financial interest in asbestos monitoring work performed by a Project Monitor. Regulations also require that an asbestos contractor shall not have any financial interests in the firm of which the Project Monitor is an employee. This section in no way relieves the abatement contractor of the OSHA requirements for personnel monitoring requirements.

In the past, OSEMA has provided all project monitoring services for asbestos abatement jobs performed by the Facilities Engineering Support Services (FESS) Contractor removal team. For all future projects, the following information applies:

- OSEMA will provide Project Monitors and personnel sampling for all asbestos work being performed at LaRC that is ≤ 10 square feet or 10 linear feet. This information is taken to ensure Government employees' protection and will be provided to the FESS Contractor for informational purposes only. This support in no way relieves the abatement contractor of the OSHA requirements or personnel monitoring requirements.
- OSEMA will monitor all glove bag removal operations and small containment jobs (≤ 10 square feet or 10 linear feet) at no additional cost. Additionally, OSEMA will spot check areas exterior to the containment area and at the clearance inspection to protect civil service employees adjacent to the regulated areas.
- Personnel monitoring of all other jobs (≤ 10 square feet or 10 linear feet) will be the responsibility of the asbestos abatement contractor only.
- The FESS Contractor will assume responsibility for personnel monitoring of its employees for regulatory compliance as required by Federal Law (OSHA 29 CFR 1926.1101) on all jobs ≥ 10 square feet or 10 linear feet.
- LaRC Work Control will need to notify the FESS Contractor and OSEMA in advance of any asbestos removal work requiring a 20 day notification to the Commonwealth of Virginia. A 20 day notification is required on all work that involves removal of more than 10 linear feet or 10 square feet of asbestos containing material (ACM). Additionally, notification to OSEMA shall include the total amount of ACM to be removed and anticipated start dates for monitoring and for clearance sampling to be conducted.

Operational considerations for asbestos-related activities are as follows:

- Prior to any operation involving removal, repair, or any other procedure which may result in release of airborne asbestos, an inspection will be conducted to evaluate the potential hazard and to recommend appropriate controls.
- The inspection team will consist of the LaRC Industrial Hygienist, the contractor safety official, the contractor operational supervisor ("competent person" as defined by OSHA regulations), and a facility representative, either the FSH or FC. The inspection team will establish operational and control procedures

which are documented through issuance of OSEMA Organizational Form N-1506, "Asbestos Safety Permit " (see Figure 4.3).

ASBESTOS SAFETY PERMIT

JOB DESCRIPTION AND LOCATION DURATION	CURRENT DATE START DATE ESTIMATED JOB

ASBESTOS WORKER'S NAME	LICENSE NUMBER	ASBESTOS WORKER'S NAME	LICENSE NUMBER

SAMPLE

CONTROLS

☐ TYVEK COVERALLS ☐ RESPIRATOR (TYPE) ☐ HEPA VACUUM ☐ OTHER _____
☐ GLOVES ☐ AREA CONTROLS/ENCLOSURE ☐ NEGATIVE AIR
☐ GLOVE BAG ☐ WET METHOD ☐ SHOWER

MONITORING REQUIREMENTS

☐ AREA MONITORING

☐ PERSONAL MONITORING DURING REMOVAL

NOTIFICATION REQUIREMENTS

☐ COMMONWEALTH OF VIRGINIA ☐ U. S. ENVIRONMENTAL PROTECTION AGENCY

APPROVALS

CONTRACTOR SAFETY OFFICER (SIGNATURE)	LICENSE NUMBER	DATE
CONTRACTOR INSULATION SUPERVISOR (SIGNATURE)	LICENSE NUMBER	DATE

COGNIZANT OFFICIALS

LaRC SAFETY MANAGER (SIGNATURE)	DATE
FACILITY REPRESENTATIVE (SIGNATURE)	DATE

NASA Langley (Rev. September 1997) Prescribing Document LAPG 1740.2 OSEMA N-1506
PREVIOUS EDITIONS OBSOLETE

Figure 4.3, Asbestos Safety Permit

- Applicable portions of 29 CFR 1926.1101, "Asbestos," will be incorporated as appropriate into all asbestos operations.
- Asbestos Configuration Management reporting will be coordinated in accordance with LAPG 1740.4, "Facility Systems Safety Analysis and Configuration Management," Chapter 8.
- Asbestos materials will be disposed of in accordance with Federal, State, and local rules and regulations. Implementation will be the contractor's responsibility in coordination with the Office of Environmental Engineering (OEE), OSEMA.
- Asbestos removal operations shall be conducted in accordance with LAPG 8800.1, "Environmental Program Manual," Chapter 9, "Asbestos."
- Replacement insulation will be asbestos-free and identified with stickers which say **"Non-Asbestos"** or **"Asbestos Free."**

4.6 SECURITY (SECURE) AREAS

Design, operational, and emergency access safety requirements for secure areas are presented in this section.

4.6.1 Design Safety

All requests for "security areas" which require facility modification will generally be accomplished by submitting NASA Langley Form 69, "LaRC Work Request," with a sketch or drawing, to the Zone Maintenance Manager. The security and safety representatives will physically review and approve the requested areas to ensure compliance with security and life safety regulations. Specific security hardware, hardware locations, facility access/egress routes, and so forth, will be annotated on the sketch/drawing and signed by the FSH. The approval document (copy) is to be posted at the entrance with the authorized entry personnel roster.

For areas where modification is not required, the OSFA, OSEMA, must be informed by the requester and/or the Office of Security and Public Safety (OSPS), OSEMA, so that a safety review can be performed. (See LAPD 7000.2, "Review Program for Langley Research Center (LARC) Facility Projects.")

4.6.2 Operational Safety

The FSH will post at the main entrance door(s) a roster of two or more persons who can be contacted for after duty hours entry. If the FSH is not on the approved access list, an organizational FSH will be appointed to exercise safety responsibilities within the security area. All security area operations require that the buddy system be used.

During the annual facility safety and health audit, the safety specialist responsible for the facility will review "security areas" for safety policy compliance. Appropriate access authorization will be obtained through security channels by the safety personnel involved.

4.6.3 Emergency Access

Facility personnel must be aware that in the event of a mishap, safety personnel will have access to the security area after showing their badges and identifying themselves. OSPS has a list of safety personnel for cross reference and identification.

4.6.3.1 Health/Injury Emergency

- CoH medical personnel will respond.
- Medical personnel will obtain immediate entry to the area (forced entry if access doors cannot be immediately unlocked).
- OSPS will respond to the request and, after response activities are complete, debrief all involved parties who gained access.
- After affected personnel obtain medical treatment, the employee will report the incident in accordance withLMS-CP-4760, “Reporting Injuries, Illnesses, Compensation Claims and Unsafe Working Conditions.”

4.6.3.2 Fire Alarm

The Fire Department will respond to a fire alarm as follows:

- Obtain immediate entry (forcing doors if doors are not immediately unlocked).
- Locate and extinguish the fire.
- After the fire is extinguished, relinquish control of the area to OSPS, who will debrief all response personnel when the emergency response is completed .

4.7 PROBLEM/FAILURE REPORTS (PFR)

Although the Center-wide PFR system has been shut down, facilities are encouraged to report problems/failures through the computerized maintenance management system with OSEMA being informed of the problem/failure.

Continue to Next Section